SYSTRON DONNER
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MODEL RS320-1.5B S6181

INSTRUMENT DIVISION

ADDENDUM

The Model RS320-1.5B S6181 is similar to the standard Model RS320-1.5B with the following exceptions:

1) Special chassis Part Number 120712

2) Special top cover Part Number 120704

3) Special Schematic Number 12073

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MODEL RS320-1.5B

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OPERATING AND SERVICE MANUAL

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CHAPTER 1

DESCRIPTION

1.1 INTRODUCTION

The Silicon Rack Series power supplies are flexible and dependable sources of DC power which can be used to meet a variety of needs ranging in scope from inspection and production testing, to laboratory bench testing and systems applications.

The wide range of outputs available makes these units well suited for use as basic laboratory power sources. The ability to provide power packaged in minimum space with high reliability meets the demands of most systems requirements.

All components used in the construction of the Silicon Rack units are of the highest quality available, and have been subjected to 100% incoming inspection.

Each electrolytic filter capacitor is of computer grade, and has been quoted by the manufacturer as having a life expectancy exceeding ten (10) years. All semiconductors are silicon for high temperature operation, and permit fully reliable operation at ambient temperatures up to 71°C without any derating, addition of heat sinks or forced air cooling. Each power transistor has been generously "derated" and temperature aged to provide high reliability. All rectifiers are hermetically sealed silicon types, and all Zener diodes have been temperature stabilized.

1.2 GENERAL FEATURES

Output, Sensing, Remote Voltage Programming and Remote Current Programming terminals are located on terminal boards mounted on the rear panel of the unit. The Power switch, Power on indicator light, mode indicator light, current and voltage controls and appropriate metering devices are all located on the front panel. For convenience, additional output terminals have been provided on the front panel.

Constant Voltage Mode

A constant voltage is maintained across the output terminals at any preset value from zero to rated voltage output, provided that the load does not draw more than either the rated output current or more than the preset limiting current value determined by the front panel current control settings.

Constant Current Mode

Constant current operation is achieved by maintaining a constant voltage across an internal current sensing resistor. An automatic crossover network changes the mode of operation from Constant Voltage to Constant Current when the current demand reaches that of the preset current adjust control. The crossover point is adjustable, and can be established anywhere within the current and voltage range of the unit.

1.2.1 Automatic Current Limiting

Short circuit protection is provided by the Automatic Current Limiting circuit which limits the maximum output current under all load conditions. The point at

which automatic current limiting occurs is variable, and may be selected anywhere from 1% of the rated current to the full rated current output of the unit. In the event of a short circuit, the output voltage drops to zero, and returns to normal only when the short circuit is removed.

1.2.2 Mode Indicator

A front panel mode indicator light indicates when the unit is operating in either the constant current or current limiting mode of operation.

1.2.3 Automatic Overvoltage Protection (Optional Feature)

Automatic Overvoltage (OV) Protection is available as an option wherein special circuitry automatically tracks the programmed output voltage and prevents it from exceeding this output voltage. The voltage differential that will cause the OV to trip is approximately 5% or 1.5 V above the programmed voltage. An internal sensitivity control is provided to desensitize the overvoltage protection circuit.

1.2.4 Remote Programming

Remote Programming is provided in both the voltage and current modes of operation. Both voltage and current may be remotely programmed over their entire ranges. The scale factor for Remote Voltage Programming is 100 Ω per volt. The Remote Current Programming is approximately determined by computing the value of the programming resistor using the formula $R_{PGM} = 100 \left(1 - \frac{\text{LOAD CURRENT}}{\text{RATED CURRENT}}\right)$.

1.3 PRECAUTIONARY MEASURES

1.3.1 Wire Size

To assure proper regulation under all load conditions, and to prevent severe distortions of the AC line voltage, it is very important to take into consideration the physical size and current handling capabilities of the input power line. Serious losses in regulation and an increase in ripple may result from under rated or overloaded AC input lines. The maxiumum AC impedance from the breaker box to the power supply input should not exceed 0.75 ohms.

1.3.2 Voltage Regulator and Inverter Inputs

Do not use voltage regulators or inverters as a primary power source. The outputs of these devices are usually not sinusoidal in nature, and if used as the AC source for the power supply, will cause serious loss of regulation of the power supply output. Capacitive input filtering used for semiconductor power supplies requires charging to the peak of the rectified AC wave which non-sinusoidal AC sources cannot provide.

Systems Considerations

In systems applications it is recommended that each power supply input power line be run separately to the AC distribution box, in order to minimize cross coupling and interaction between equipment. Do not run sensitive signal leads such as the remote sensing leads in the same cable as the AC input without shielding. To keep

the AC ripple in the output to a minimum, it is receommended that the AC input cables should be run in close proximity to the output load cables.

Terminal Post Resistance

All terminals and shorting links serving Outputs, Sensing and Programming must be securely tightened before use. Serious loss of regulation and an increase in ripple can result due to a voltage drop caused by loose terminals and shorting links.

Variable Transformer Input

If a variable transformer is to be used to test the power supply for low and high AC line operation, it must be able to supply at least twice the VA requirements of the power supply and load.

CHAPTER 2

INSTALLATION AND OPERATION

2.1 MECHANICAL INSTALLATION

Rack Mounting

Any standard EIA relay rack will accommodate the Silicon Rack Series power supplies in only 3-1/2" of vertical mounting space. Mounting of the unit is easily accomplished by inserting four mounting screws through the slotted holes provided in the four corners of the front panel of the power supply, and on into the matching threaded holes of the relay rack.

Bench Use

Though designed primarily for rack mounting, the Silicon Rack Series power supply may be operated in a bench type configuration as well. It is threrfore fully enclosed in a protective metal case, and equipped with rubber mounting feet which serve to protect the unit and the surface upon which it rests from scratching, and to provide an airflow channel under the unit for ventilation purposes.

2.2 ELECTRICAL CONNECTIONS

AC Input

A three terminal barrier strip mounted on the rear panel provides AC input connections to the unit.

A power handling ability of the AC power lines feeding AC power to the unit must be considered, as serious losses in regulation and substantial increases in ripple can occur as a result of insufficient power handling capacity of these lines. The AC impedance from the breaker box to the power supply input connector should not exceed 0.75 Ω. Any movable electric contact surface (such as the wiper arm of a variable transformer) should be kept clear of impedance producing oxide coatings.

Care should be exercised in selecting the proper wire size for the AC input lines. The figures listed in Table 2-1 will serve as a guide in making this selection.

Table 2-1. AC Input Wire Size

Length of Run (Single Lead)	Wire Size (AWG Standards)
10 feet or less	14
10 feet to 20 feet	12
20 feet to 50 feet	10
50 feet to 100 feet	8

Rear Panel Barrier Strip

A seven terminal barrier strip mounted on the rear panel provides programming and ground connections. Terminals 1 and 2 provide Remote Current Programming connections, terminals 4 and 5 provide Remote Voltage Programming connections, and terminal 3 is utilized as a ground connection.

DC Output

A heavy duty block containing stud type terminals is provided for DC output and sensing connections. Table 2-2 Shorting Link Application, lists the various shorting link connections required for any of the various modes of operation. Three binding post terminals mounted on the front panel provide output and ground connections. These terminals are primarily for convenience purposes and for each monitoring of the output.

Local Sensing

Local sensing of the output voltage is made at the rear panel output terminals. The shorting links must be placed across rear panel terminals (-V and -S) and (+V and +S).

Remote Sensing

Remote sensing of the output voltage is available only if the load is connected to the rear panel output terminals. The shorting links between the (-V and -S) terminals must e removed and separate sensing leads installed between the sensing terminals (-S and +S) and the load.

Local Programming

Local Programming of either current or voltage is available by shorting the appropriate rear panel terminals. For local current programming operation, a shorting link should be placed across barrier strip terminals 4 and 5 (RVP). In both local current programming and local voltage programming operation, the output amplitude is dependent upon the setting of the appropriate front panel adjustment control

Remote Programming

Remote programming of both voltage and current may be achieved by removing the shorting link from the appropriate barrier strip terminals and substituting a remotely operated adjustment control resistance in its place.

In the remote voltage programming mode of operation, the scale factor required for the remotely operated voltage adjustment control is 100 Ω per volt. In order for this remotely operated adjustment control to function properly, the front panel voltage adjustment controls must be set fully CCW. Operation of this power supply without either shorting link or remotely operated adjustment control connected across remote voltage programming barrier strip terminals 4 and 5 (RVP), will result in an unregulated output voltage.

The required size of the remote curent programming resistor may be determined by use of the formula $R_{PGM} = 100 \left(1 - \frac{\text{LOAD CURRENT}}{\text{RATED CURRENT}}\right)$, where R_{PGM} is the remote program resistor, load current refers to the desired output current, and rated current refers to the maximum output current of the unit. To obtain proper operation of the remotely controlled current adjust control, it is necessary that the front panel current adjustment controls be set fully CW. Operation of this power supply without

either shorting link or remotely adjusted current programming control connected across remote current programming barrier strip terminals 1 and 2 (RIP) will result in a complete loss of output current.

Shorting Links

The unit is shipped with shorting links in place across terminals 1 and 2, 4 and 5, -V and -S and +V and +S of the barrier strips. In this configuration, local programming and sensing is available at the barrier strip terminals. Table 2-2 lists the various shorting link connections and their functions.

Table 2-2. Shorting Link Application

Terminals	Condition	Function
-V and -S +V and +S	Shorted Shorted	Local sensing and regulation at rear panel output terminals.
-V and -S +V and +S	Not Connected Not Connected	Remote sensing and regulation at load.
4 and 5	Shorted	Voltage programmed locally, output dependent upon voltage adjust pots.
4 and 5	Ext. PGM Res.	Voltge programmed remotely, output dependent upon size of PGM resistor.
1 and 2	Shorted	Current programmed locally, output dependent upon current adjust potentiometers.
1 and 2	Ext. PGM Res.	Current programmed remotely, output dependent upon size of PGM resistor.

2.3 CONTROLS

2.3.1 Front Panel

Table 2-3. Front Panel Controls

Name	Function
AC POWER	Power switch, controls input power.
VOLTAGE ADJUST (Coarse)	Potentiometer, adjusts voltage output.
VOLTAGE ADJUST (Vernier)	Potentiometer, adjusts voltage output.
CURRENT ADJUST (Coarse)	Potentiometer, adjusts current.
CURRENT ADJUST (Vernier)	Potentiometer, adjusts current.

Internal

All internal control settings have been factory preset and require no additional adjusting. However, if it should become necessary to adjust any of the internal controls due to circuit changes caused by component aging or replacement, refer to the calibration section of this instruction manual.

2.4 OPERATION

Control Settings

Set all front panel controls fully CW so that unit will operate in the Voltage rather than Current Limiting mode.

Shorting Links

If Local Sensing rather than Remote Sensing operation is desired, ascertain that shorting links are in place across the appropriate terminals.

Grounding

Either side of the Output may be grounded, or the Output may be used in a floating condition.

Power On

Connect the power supply to a nonimal AC power source. Set the Power switch to AC-ON, and observe that pilot lamp DS1 glows.

Warm-Up

No warm-up time is necessary to place the unit into operation. However, a 30 minute warm-up period is recommended to reach rated stability.

Series Operation

To operate two or more power supplies in a series configuration, connect the output of each power supply in series. When operating in this mode, it is necessary to adjust the output of each unit independently. The output voltage is equal to the sum of the voltage settings of each power supply.

Parallel Operation

a. With rated resistive load connected across the output of Power Supply A as shown in Figure 2-1A set VOLTAGE ADJUST control to desired output voltage, and set CURRENT ADJUST control for maximum rated output current.

b. Connect Power Supply B as shown in Figure 2-1B. With no load across the output, set VOLTAGE ADJUST control for an output voltage 2 V higher than the output voltage of Power Supply A. Place a short across the output terminals, and set the CURRENT ADJUST control for 1/2 the total load current requirement.

c. Remove all former output loads and connect the outputs of Power Supplies A and B in parallel with each other, and in parallel with the load, as shown in Figure 2-2.

d. If parallel operation of these two Power Supplies is desired for a systems application, it is important that both units be turned on simultaneously. It is therefore recommanded that both Power Supplies be connected to a single large circuit breaker. Maximum output current will be twice that of either of the two Power Supplies while minimum output current will be that of Power Supply B, or half the total load current.

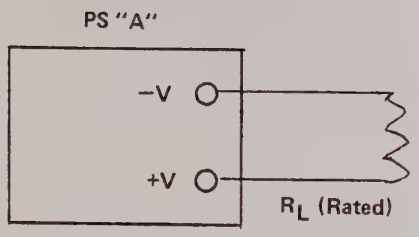

FIGURE 2-1A

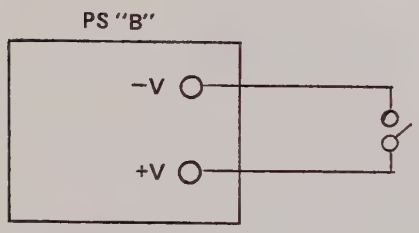

FIGURE 2-1B

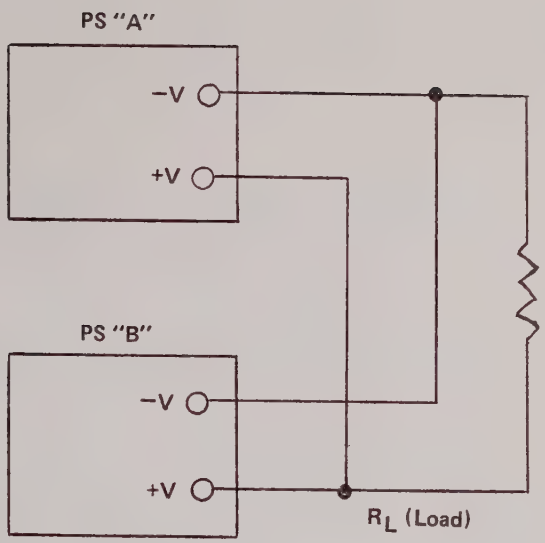

FIGURE 2-2

NOTE: Disconnect the gate lead from the OV SCR in Power Supply A.

CHAPTER 3

THEORY OF OPERATION

3.1 GENERAL

The purpose of the Silicon Rack Series Power Supplies is to transform and rectify the AC input into a well-regulated, stable and adjustable DC output. The following paragraphs describe the major circuits used in the Power Supplies. As each circuit is described, reference should be made to both the Block Diagram Figure 3-1 and the Schematic Diagram in the rear of this manual.

Primary Input

Input power is obtained through power transformers T1 and T2 and full wave silicon diode rectifiers. Each pair of rectifiers provide the necessary DC voltages to the various sections of the unit.

When AC power switch S1 is set to AC-ON, AC pilot lamp DS1 glows, and AC power is applied to the power transformers. Regulated DC output power is immediately available from the Power Supply.

Reference Supply

The rectified and filtered voltage from rectifiers CR1 and CR2 and filter capacitor C1 is pre-regulated by Coarse Reference Regulator Zener CR3. This provides a stabilized DC voltage to Constant Current Source Q2, whose output is regulated by Precision Voltage Reference Zener CR16. Constant Current Source Q1 controls the drive to Q2 and in turn is controlled by Q2. The voltages developed across Constant Current Source References CR4 and CR16 are highly stable reference voltages established at a higher positive potential than the positive output of the Supply.

Pre-Regulator

The purpose of the Pre-Regulator section is to maintain the unregulated input voltage on Input filter Capacitor C22 at a suitable value compared to the output voltage in order to lower the power dissipation across the Series Pass section of the Series Regulator.

The method used to accomplish this is to "fire" a pair of SCR's (silicon controlled rectifiers), CR27 and CR28, at controlled points along the input sine wave to increase or decrease the potential to which the input filter capacitor may charge. The SCR's are "fired" (allowed to pass current) by the application of a positive pulse at the junction of gating resistors R57 and R58 from amplifier Q11, which amplifies the triggering pulse from unijunction transistor Q13. The unijunction transistor triggers the SCR's when charged sufficiently by timing capacitor C10 to cause conduction. The SCR's are turned off with each alternate half cycle of the input sine wave. Adjustment of R42 is factory set to the optium full load firing point of the SCR's.

Series Regulator

The pre-regulated DC voltage from the SCR's is directed through the Series Pass transistors. The conduction of these transistors is controlled by circuitry which causes them to act as variable resistors. Their overall resistance varies in accordance with the need of the Power Supply to increase or decrease its output voltage or current.

The Series Pass transistors are controlled by several driver stages which amplify signals from the error amplifier.

Comparator and Error Amplifier

The voltage sensing and comparison is accomplished by differential amplifier Q10. A sample of the output voltage on the base of Q10 is compared to the stable reference voltage on the base of comparator Q9. An unbalanced caused by a change in voltage at either the negative sensing terminal or across voltage adjustment controls R55 and R56 will appear as a voltage change in the collector of Q10.

The difference voltage is amplified by error amplifier Q6, and is used to regulate the Series Pass transistors via the Series Pass drivers. Error amplifier Q6 has two diode inputs to its base which form an OR gate for error signals. CR7 supplies error signals from the comprator, and CR6 supplies an error signal in the event of a short circuit, or if the Power Supply is driven into the current lmiting mode of operation.

When operating in the current limiting mode, differential amplifier Q3 and Q4 become balanced, causing diode CR6 to conduct, and in turn drives error amplifier Q6 toward cut-off. This signal also causes Q7 to conduct, thereby causing current mode indicator lamp DS2 to glow.

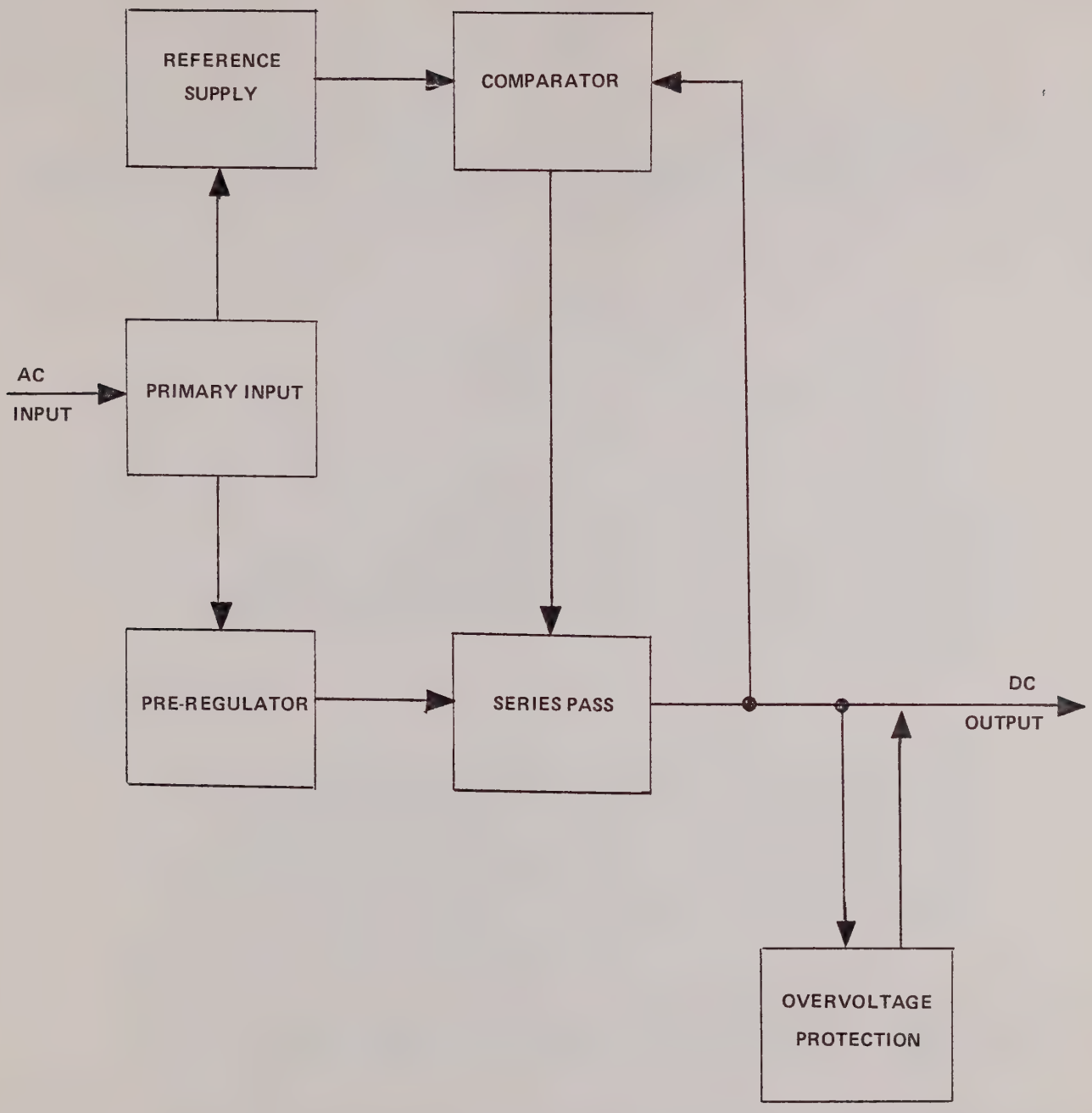

Figure 3-1. Block Diagram

CHAPTER 4

MAINTENANCE

4.1 GENERAL

This Power Supply is a precision instrument. It is strongly recommended that only experienced troubleshooting personnel perform troubleshooting operation or attempt to repair the unit. If the Power Supply appears to be malfunctioning at all, the following procedure is recommended for isolating possible defects.

W

High Voltages Are Present
Use Caution

4.2 LOADS AND INTERCONNECTIONS

1. Disconnect all loads and interconnections.

2. Connect a resistive load across the output terminals, and operate the unit to determine whether the fault lies within the unit or externally. Observe that shorting links are in place across terminals 1 and 2, 4 and 5, -V and -S and +V and +S, and that all connections are tightly made.

4.3 TROUBLESHOOTING

1. Set the VOLTAGE ADJUST controls fully CW. Use a 20,000 ohms per volt voltmeter or oscilloscope to check the voltages across the various circuit components listed in the Troubleshooting Guide located at the end of this Chapter. Any reading which is grossly incorrect indicates that the stage being tested or the one immediately preceding it, is defective. The Block Diagram, Schematic Diagram and appropriate sections of the Theory of Operation will prove helpful in any troubleshooting work. Proper polarity to be observed when testing, can be easily obtained from the Schematic Diagram.

2. If voltage checks show no noticeable deviations from the prescribed values, disconnect AC power and proceed with point to point resistance checks across potentiometers, switches, diodes, resistors, transistors, in that order.

3. When the trouble is of an intermittent nature such as poor regultion, ripple, etc., the use of an oscilloscope to determine dynamic changes will be necessary.

Troubleshooting Guide

Section	Component	DC Volts ±10%
Reference	CR3	24.0
	CR4	5.8
	CR16	9.3
	R9	2.6
Pre-Regulator	C22	340.0
Series Regulator	C29	300.0
	Q15,Q16,Q18,Q20	0.7
	CR31	5.0
Comparator and Error Amp	Q6	0.7
	Q9,Q10	0.65
	R18	6.2
	R19	3.1
	R21	3.3
	R23	2.5

NOTE: Base to emitter voltages of all transistors in the Series Regulator should be positive for conduction.

CHAPTER 5

CALIBRATION

5.1 GENERAL

The following adjustments should be made when necessary to assure optimum operating characteristics and maximum efficiency of the Power Supply.

5.2 TEST EQUIPMENT REQUIRED (Or Equivalent)

1. Oscilloscope, Tektronix Type 561
2. Differential Amplifier Plug In, Tektronix Type 63
3. Time Base Plug In, Tektronix Type 67
4. Differential VTVM, Fluke Model 825A
5. AC VTVM, Hewlett Packard Model 400D
6. VOM, Simpson Model 260
7. Variable Auto Transformer, Powerstat Type 3PN136 (20 A rating)

Shorting Link Application

For test purposes, shorting links should be connected across terminals 1 and 2, 4 and 5, -V and -S and +V and +S, to provide local sensing and local programming. To reduce pick up, shielded wire must be used for all connections between test equipment and the Power Supply being tested. To prevent ground loops, it is important that only one ground connection be made, as shown in Figure 5-1 and Figure 5.2. Tighten all terminal connections as securely as possible, and set all front panel controls fully CW.

5.3 CALIBRATION PROCEDURE

Pre-Regulator

1. With Power Supply operating without a resistive load across the output terminals, vary the VOLTAGE ADJUST controls until 100% of rated voltage output is indicated on the DC voltmeter. Set the AC POWER switch to OFF, and connect a resistive load across the output terminals. Set the AC POWER switch back to ON, and adjust the resistive load for rated current setting on ammeter.

2. Set oscilloscope to DC triggering mode and connect oscilloscope input across the positive terminals of input capacitor C22 and output capacitor C14.

3. Adjust Pre-Regulator Input Balance control R29 for a balanced 120 Hz sawtooth shaped waveform.

4. Adjust Series Pass Voltage control R42 for approximately 10 V dc, measured between the positive terminals of input capacitor C22 and output capacitor C14.

5. Vary AC input voltage 10% above and below the nominal input level. Observe that the voltage measured between the positive terminals of the input and output capacitors, does not vary by more than 20%, at either input voltage extreme.

Voltage Adjust Control

Maximum Voltage

Set front panel VOLTAGE ADJUST and VOLTAGE VERNIER controls fully CW. Adjust Maximum Voltage control R24 to obtain an output voltage 0.5 V dc in excess of the maximum rated output voltage.

Minimum Voltage

Set front panel VOLTAGE ADJUST and VOLTAGE VERNIER controls fully CCW. Adjust Minimum Voltage control R27 to obtain a negative output voltage of 0.2 Vdc.

Readjustment

Adjustment of either Maximum Voltage control R24 or Minimum Voltage control R27 will have an effect upon the other. Therefore, these controls should be readjusted if necessary, as outlined above, upon initial completion of this adjustment.

N

If partial rotation of the VOLTAGE ADJUST controls produces no apparent change in indicated output voltage, further rotation of these controls should not be attempted. Rotation of these controls fully CCW with little or no output voltage regulation can result in damage to the controls, the load, or both. Set the AC POWER switch to OFF, and proceed with the troubleshooting as outlined in Chapter 4 of this instruction manual.

Set front panel VOLTAGE ADJUST and VOLTAGE VERNIER controls fully CCW and observe that the voltage indicated on the unit and test voltmeters drops slightly below the zero setting of the meters. The output voltage should be approximately negative 200 mV. Reset voltage controls fully CW.

Current Adjust Controls

Maximum Current

Connect a test ammeter having a full scale current indicating capacity of 150% that of the rated current output across the output terminals of the Power Supply. (Set all front panel controls fully CCW.) Apply power to the unit under test and slowly rotate CURRENT VERNIER controls fully CW. Observe that the maximum current obtainable is approximately 110% that of the maximum rated current output. If it is not possible to achieve 110% of the maximum rated current output, adjust Maximum Current control R72 until that value is attained. Set AC Power Switch to OFF.

Connect a suitable load resistance across the output terminal connections. The load resistance must be able to dissipate the rated power of the unit (P = IE) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Set AC Power Switch to ON. Note the voltage indicated on the Differential VTVM. Disconnect the resistive load from the output and observe the voltage indicated on the Differential VTVM. The maximum change in output voltage should not exceed by more than 0.01% or 3 mV (whichever is greater) that of the output voltage indicated with the load resistance applied across the output terminals.

If it is not possible to maintain the load regulation as stated in the preceding paragraph, readjust Maximum Current control R72 slightly and recheck the load regulation.

Minimum Current

Connect test ammeter, having a full-scale current indicating capacity of 100 mA, across output terminals in place of a load resistor. Set all front panel controls fully CCW and apply power to the unit under test. Slowly ratate VOLTAGE ADJUST control in a CW direction, until current meter indicates a current flow somewhere between 0-50 mA. Adjust Minimum Current control R80 for a nominal current indication of 1% of the rated current. Set the POWER ON switch to OFF.

Constant Voltage Operation

Load Regulation

With the equipment connected as shown in Figure 5-1, connect a suitable load resistance across the Output terminal connections. The load resistance selected must be able to dissipate the rated power of the unit ($P = IE$) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Note the voltage indicated on the Differential VTVM. Disconnect the resistive load from the output. The maximum change in output DC voltage indicated on the Differential VTVM should not exceed by more than 0.01% or 3 mV (whichever is greater) that of the output voltage indicated with the load resistance applied across the output terminals.

Line Regulation

Place the resistive load across the output and note the voltage indicated on the Differential VTVM. (Vary the input line voltage ±10%.) The maximum change in output voltage should not exceed by more than 0.01% or 3 mV (whichever is greater) that of the output voltage measured at either extreme of the AC input.

Ripple Voltage

In order to reduce pickup, shielded test leads should be used in making ripple measurements. With the resistive load connected across the output terminals, measure the AC ripple with the AC VTVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum ripple amplitude should not exceed 0.5 mV rms.

Constant Current Opertion

Load Regulation

With the equipment turned off, disconnect the resistive load from the output terminals. Connect a small current sensing resistor in series with the resistive load and then connect the load back across the output terminals. Selection of the proper value for the current sensing resistor may be easily made using the formula $R_S = \frac{I}{I_R}$ where R_S = Value of Cur-

rent Sensing Resistor and I_R = Rated Load Current. Connect the equipment as shown in Figure 5-2, and apply power to the Power Supply.

Vary the VOLTAGE ADJUST controls and resistive output load as necessary, to achieve rated current and voltage output. Decrease the load resistance until current meter reading exceeds full scale indication. Rotate CURRENT ADJUST control CCW to return the current meter reading to full scale. Observe tht the output voltage has decreased from its previous full scale reading, and that increasing the VOLTAGE ADJUST controls has no effect upon the output voltage or current. This indicates that the unit is now operating in the Constant Current Mode.

Measure the voltage across the small sensing resistor. Compute and note the current flow through this resistor. Change the output load from the resistive load previously used, to a short. Again measure the voltage across the small sensing resistor and compute the value of the current flow through this resistor. The change in current should not exceed by more than 0.5% the rated current previously noted with a full resistive load across the output.

Line Regulation

Replace the resistive load across the output and measure the voltage drop across the small sensing resistor. Compute and note the current flow ($I = \frac{E}{R}$) through this resistor.

Vary the input line voltage ±10%. Note the maximum change in voltage across the sensing resistor and compute the maximum current flow. The maximum change in current should not exceed by more than 0.5% the rated current previously noted at either extreme of the AC input.

Ripple Current

With the AC input line voltage adjusted to the nominal AC input voltage and the resistive load connected across the output, measure the amplitude of the AC ripple as seen across the sensing resistor with the AC VTVM. Compute and note the curent flow. Vary the AC input line voltage ±10%. Measure the maximum voltage drop and compute the maximum current flow. The maximum ripple current must not exceed by more than 0.25% or 5 mA (whichever is greater) that of the current flow noted during input line voltage.

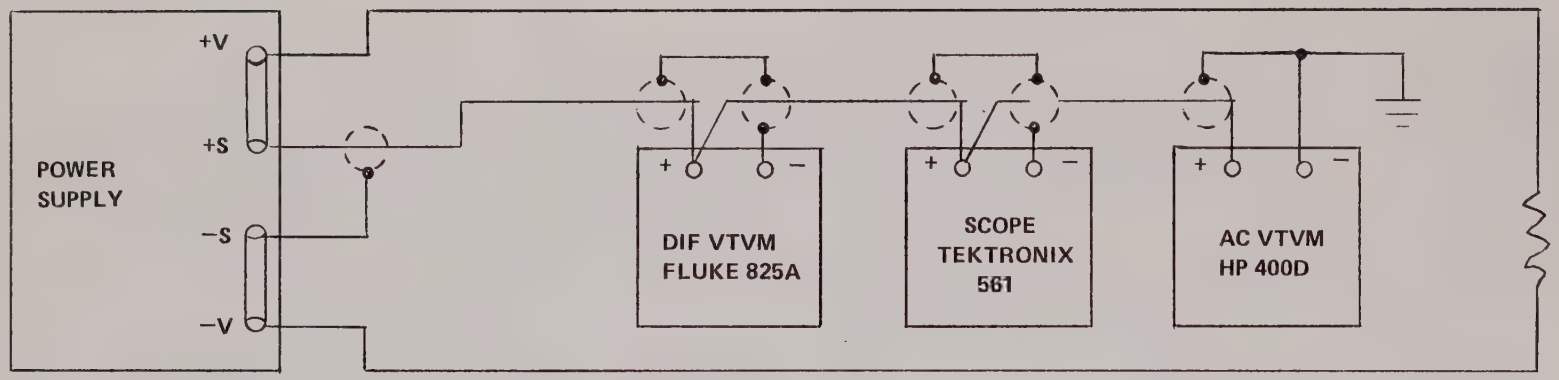

Figure 5-1. Constant Voltage Operation

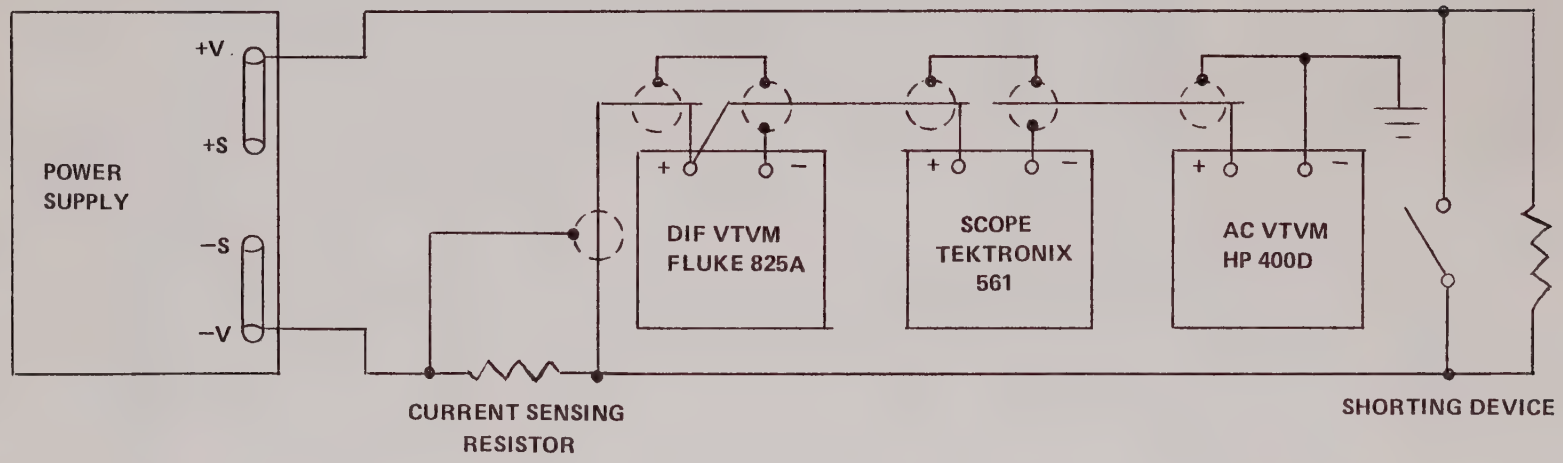

Figure 5-2. Constant Current Operation

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY	SHT QTY
1		004090	SHIPPING ASS'Y					
3	E		SCHEMATIC	078500	1	R		
6	D	076268	TOP COVER		1	2		
9	A	PD13030	FRONT PANEL ASS'Y		1	2		
10	D	076278	FRONT PANEL		1	2		
11		880030	AC-SWITCH	S1	1	1		
12		770020	PILOT LIGHT	DS1	1	1		
13		770023	INDICATOR LAMP	DS2	1	1		
14		600010	POTS 10Ω-2W	R78	1	1		
15		600059	100Ω-2W	R77	1	1		
16		600100	250Ω-2W	R55	1	1		
17		600372	50K-4W	R56	1	1		
18		800254	CAPACITOR .22-400V	C30	1	1		
19		102647	BINDING POSTS-BLK		1	1		
20		T920160	" " -RED		1	1		
21		102648	" " -WHT		1	1		
22	B	T049260	COVER SUPPORT		1	2		
23	B	065042-02	METER ASS'Y 320 VOLTS	M1	1	2		
24	B	06502501	METER MVMT 1ma 77Ω		1	1		
25		117114	DIAL	B065025	1	1		
26	B	065048	P.C. BOARD METER MULTIPLIER		1	1		
27		117125	POT 20KΩ	R401	1	1		
28		117128	RESISTOR 309K	R402	1	1		
29		103862	HEX NUT		2	1		
30	A	065075-01	METER ASS'Y 2 AMP	M2	1	2		
31	B	06502501	METER MVMT 1ma 77Ω		1	1		
32		117114	DIAL	B065075	1	1		

REVISIONS
REV | DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDENT
				52542

PLANNER | PREP DATE | CHK'D | APP'D | MAT. DUE | B/U REQ. | B/U COMP | USED ON

SYSTRON DONNER CORPORATION

SHIPPING ASS'Y
RS 320-1.5B

DRAWING NO.

REF	SIZE	PART NO.	REV
—	P	004090	

SHEET 1 OF 9

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY
34			FRONT PANEL ASS'Y (CONT.)				
36		117377	FUSE-HOLDER	F1	1	1	
37		870200	FUSE 10 AMP SLO-BLO		1	1	
38		T920100	Knobs		4	1	
42		PD13022	CHASSIS ASS'Y		1	2	
43	E	076248	CHASSIS		1	2	
44		840192	RUBBER FEET		4	1	
45		505575	XFORMER	T1 PD13027	1	2	
46		505578	"	T2	1	2	
47		820138	CAPACITOR 2200MF-40dV	C22	1	1	
48		820036	750MF-350V	C14	1	1	
49		820027	90MF-400V	C29	1	1	
50		820050	950MF-50V	C1	1	1	
51		800295	.47MF-400V	C23	1	1	
			XFORMER T2-WIRING	PD13028	1	R	
52	B	076368	CAPACITOR BKT		2	2	
53	B	046598	" "		2	2	
54		100725	" "		2	1	
56		650095	RESISTORS .67Ω-25W	R76	1	1	
57		650570	150Ω 25W	R1	1	1	
58		650804	5KΩ-50W	R59	1	1	
59		650818	15KΩ-50W	R82	1	1	
61	B	076358	RESISTOR BKT		2	2	
62	B	T028728	MTG. BKTS		2	2	
63		860110	3/4" HEX SPACERS		4	1	
64		T900130	AUGAT BKTS		2	1	
65		T920040	HANDLES		2	1	

REVISIONS
DESCRIPTION
BY

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDE
				5254

PLANNER	PREP DATE	SYSTRON DONNER CORPORATION
	CHK'D	SHIPPING ASS'Y
MAT. DUE	APP'D	RS320-1.5B
B/U REQ.		DRAWING NO.
B/U COMP		REF SIZE PART NO. -- P 004090

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY	SHT QTY
66	A	PD13029	DIODE BKT ASS'Y		1	2		
67	C	076348	DIODE BKT		1	2		
68		720137	" IN1206A-IN3622	CR32	1	1		
69		720241	" IN1360A	CR3	1	1		
70			MICA-WASHER	T990307	4	R		
71			INSUL.-RING	T990350	2	R		
72			FLATWASHER	T990306	2	R		
73			LOCK-WASHER	T990170	2	R		
74			HEX NUT	T980101	2	R		
75			LUG	T960085	2	R		
79	A	PD13804	SHUNT BOARD ASS'Y		1	2		
80	B	065443	SHUNT BOARD		1	2		
81		117661	SHUNT RES. .067Ω 5W	R91-	1	1		
82		101909	POT 100Ω	R90	1	1		
83		620676	RESISTOR 29.95K 1/2W	R85, 86, 87	3	1		
88	B	PD13023	REAR PLATE ASS'Y		1	2		
89	D	076258	REAR PLATE		1	2		
90	B	076468	OUTPUT BLOCK	TB3	1	2		
91		851103	BARRIER STRIP 670Y3	TB1	1	1		
92		851107	" " 670Y-7	TB2	1	1		
93		T971005	THREADED RODS		4	1		
94		860130	HEX-SPACERS 6-32 x 1"		2	1		
95		860100	" " 6-32 x 1/2"		4	1		
96	B	T012240	SHORTING LINKS	PD14798	2	1		
97		840217	BARRIER STRIP LINKS	PD14798	2	1		
98		800254	CAPACITOR .22MF-400V	C20	1	1		

REVISIONS
REV | DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDENT
				52542

PLANNER | PREP DATE | CHK'D | APP'D | MAT. DUE | B/U REQ. | B/U COMP | USED ON

SYSTRON DONNER CORPORATION

SHIPPING ASS'Y
RS320-1.5B

DRAWING NO.

REF	SIZE	PART NO.	REV
—	P	004090	

SHEET 3 OF 9

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY
99			REAR PLATE ASS'y (CONT.)				
101	B	077048	PROTECTIVE COVER		1	2	
102	B	077058	" " DC		1	2	
103	B	065128	" " AC		1	2	
108	B	503001	CHOKE ASS'y	L1, L2	1	2	
109	A	PD13031	BOARD #2		1	R	
110	B	076398	BOARD #1		1	2	
111	B	076388	BOARD		1	2	
112	A	065143	POT CORE		1	2	
113		117315	BOBBIN		4	1	
114		117316	#4 SPEED NUT		2	1	
115		117360			2	1	
119	C	07631801	HEAT-SINK ASS'y #1		1	2	
120		720137	DIODE IN1206A-IN3622	CR25	2	1	
121			S/A CR25	CR26			
122		725130	SCR 2N3670	CR27, 28	2	1	
123		830101	TRANSISTOR SOCKETS		2	1	
124			MICA WASHERS	T990290	2	R	
125			" "	T990307	4	R	
126			INSUL. RING	T990350	2	R	
127			FLAT-WASHER	T990306	2	R	
128			LOCK-WASHER	T990170	2	R	
129			HEX NUT	T980101	2	R	
130			LUG	T960085	2	R	
131		076318	HEAT-SINK		1	1	

REVISIONS
DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDENT 5254
PLANNER	PREP DATE		SYSTRON DONNER CORPORATION	
	CHK'D		SHIPPING ASSY RS320-1.5B	
MAT. DUE	APP'D			
B/U REQ.			DRAWING NO.	
B/U COMP			REF SIZE PART NO. B 076498	

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY	SHT QTY
132	C	07632801	HEAT-SINK ASS'Y #2		1	2		
133		106607	TRANSISTOR DTS 423	Q16	1	1		
134		630020	RESISTOR .7Ω-3W	R66	1	1		
135		860020	STAND-OFF #4		1	1		
136		830101	TRANSISTOR SOCKET		1	1		
137			MICA-WASHER	T990290	1	R		
138		076328	HEAT-SINK		1	1		
143	C	07633801	HEAT-SINK ASS'Y #3		1	2		
144		106607	TRANSISTOR DTS 423	Q15	1	1		
145		700191	" 2N4915	Q18	1	1		
146		630020	RESISTOR .7Ω-3W	R65	1	1		
147		860020	STAND-OFF #4		1	1		
148		830101	TRANSISTOR SOCKET		1	1		
149		830075	" "		1	1		
150			MICA-WASHER	T990290	1	R		
151			" "	T990285	1	R		
152		076338	HEAT-SINK		1	1		
155		PD13021	MAIN P.C. BOARD ASS'Y		1	2		
156	C	076438	P.C. BOARD		1	2		
157		600071	POT 150Ω 1/2W	R24 R27	3	1		
158			S/A R24	R72				
159		600204	2KΩ 1/2W	R80	1	1		
160		600364	25K 1/4W	R42, 44	2	1		
161		101575	RESISTORS 47Ω 1/2W 10%	R57, 58	2	1		
162		101498	100Ω 1/2W 10%	R8, 28	2	1		
163		101527	150Ω 1/2W 10%	R36 R37	2	1		
164		101474	330Ω 1/2W	R13, 41	2	1		

REVISIONS
REV | DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDENT
				52542

PLANNER | PREP DATE | CHK'D | APP'D | MAT. DUE | B/U REQ. | B/U COMP | USED ON

SYSTRON DONNER CORPORATION

SHIPPING ASS'Y
RS 320-1.58

DRAWING NO.

REF	SIZE	PART NO.	REV
—	P	004090	

SHEET 5 OF 9

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY	S C
165			MAIN P.C. BD. ASS'y (CONT.)					
167		101539	RESISTOR 470Ω 1/2W 10%	R11	1	1		
168		101631	560Ω 1/2W 10%	R16	1	1		
169		101467	1KΩ 1/2W	R61 R63	3	1		
170			S/A R61	R67				
171		101454	2.2KΩ 1/2W	R38 R68	2	1		
172		101511	4.7K 1/2W 10%	R12	1	1		
173		101471	10K 1/2W 10%	R14	1	1		
174		101500	15K 1/2W	R54	1	1		
175		101440	1.5 MEG 1/2W 10%	R47	1	1		
176		102063	100Ω 1/2W 1%	R70	1	1		
177		102191	301Ω 1/2W 1%	R71, 79	2	1		
178		620140	402Ω 1/2W 1%	R17	1	1		
179		620195	562Ω 1/2W 1%	R22	1	1		
180		620210	604Ω 1/2W 1%	R75	1	1		
181		620220	681Ω 1/2W 1%	R39	1	1		
182		620250	750Ω 1/2W 1%	R9, R23	2	1		
183		620320	1.18KΩ 1/2W 1%	R4	1	1		
184		620402	1.96KΩ 1/2W 1%	R6 R7, 10	7	1		
185			S/A R6	R20, 21, 73, 74				
186		620467	2.95KΩ 1/2W 1%	R40	1	1		
187		620580	4.99KΩ 1/2W 1%	R43, 45	3	1		
188			S/A R43	R46				
189		620610	10KΩ 1/2W 1%	R2	1	1		
190		620710	49.92KΩ 1/2W 1%	R3	1	1		
191		620754	75KΩ 1/2W 1%	R15	1	1		
192		630250	100Ω 3W 3%	R25	1	1		
193		630255	130Ω 3W 3%	R26	1	1		
194		630261	170Ω 1W 1%	R5	1	1		
195		630372	750Ω 1W 3%	R19	1	1		
196		630375	750Ω 3W 3%	R84	1	1		
197		630418	1.5KΩ 1W 3%	R18	1	1		

REVISIONS
DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDE
				5254

PLANNER	PREP DATE	SYSTRON DONNER CORPORATION
	CHK'D	SHIPPING ASS'y
MAT. DUE	APP'D	RS320-1.5B
B/U REQ		DRAWING NO.
B/U COMP		REF — SIZE P PART NO. 004090

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY	SHT QTY
198			MAIN P.C. BD. ASS'Y (CONT.)		X	X		
200		630460	RESISTOR 3K 3W 3%	R32 R34	2	1		
201		640325	82Ω 2W 10%	R35	1	1		
202		640500	1K Ω 2W 10%	R33	1	1		
203		640549	4K Ω 5W 5%	R64	1	1		
204		640551	5K Ω 5W 5%	R62	1	1		
206		705067	TRANSISTOR 2N2905A	Q2, Q6	4	1		
207			S/A Q2	Q12, Q14				
208		700047	2N4238	Q11	1	1		
209		705068	2N2219A	Q1, Q20	2	1		
210		700180	2N2714	Q3, Q4, Q5	8	1		
211			S/A Q3	Q7, Q8, Q9				
212			S/A Q4	Q10, Q21				
213		720145	UNIJUNCTION 2N2647	Q13	1	1		
215		100378	DIODE ZENER IN751A	CR4, CR31	2	1		
216		720384	ZENER IN4384	CR5, 6, 7, 8	13	1		
217			S/A CR5	CR15, 18, 19				
218			S/A CR5	CR30, 33, 42				
219			S/A CR5	CR20, 23, 24				
220		100412	1N964B	CR17	1	1		
221		720397	1N2164A	CR16	1	1		
223		800006	CAPACITOR .001MF-600V	C5 C24	2	1		
224		800025	.0033MF-600V	C4	1	1		
225		800050	.0047MF-600V	C31	1	1		
226		800090	.01MF-600V	C6	1	1		
227		800147	.047MF-250V	C2	1	1		
228		800185	1MF-250V	C7 C10	2	1		
229		800254	.22MF-400V	C17	1	1		
230		810010	10MF-50V	C8	1	1		

REVISIONS

REV	DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDENT
				52542

PLANNER	PREP DATE	SYSTRON DONNER CORPORATION
	CHK'D	SHIPPING ASS'Y RS320-1.5B
MAT. DUE	APP'D	
B/U REQ.		DRAWING NO.
B/U COMP	USED ON	REF — SIZE P PART NO. 004090 REV
		SHEET 7 OF 9

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY
231			MAIN P.C. BD. ASS'Y (CONT.)		X	X	
233		810090	CAPACITOR 75MF-15V	C9	1	1	
235A		PD13024	COMPONENT BD #2 - ASS'Y		1	2	
236C		076448	" "		1	2	
237		600290	POT 5K 1/2W	R29	1	1	
238		101457	RESISTOR 330K 1/2 10%	R31	1	1	
239		611135	" 4.7MEG 1/2 10%	R30	1	1	
241		720383	DIODE ZENER 1N4585	CR38, CR39	4	1	
242			S/A CR38	CR40, CR41			
243		720384	1N4384	CR9, CR10, 11	8	1	
244			S/A CR9	CR12, 13, 14,			
245			S/A CR9	CR36, 37			
247		810161	CAPACITOR 210MF-25V	C27	1	1	
248			COMPONENT BD #2 - WIRING	PD13025	1	R	
252A		PD13026	COMPONENT BD #3 - ASS'Y		1	2	
253C		076458	" "		1	2	
254		101498	RESISTOR 100Ω 1/2W 1%	R51, 53	2	1	
255		620677	30.1KΩ 1/2W 1%	R50	1	1	
256		102206	100KΩ 1/2W 1%	R48 R49	2	1	
257		640650	30KΩ 5W	R52	1	1	
258		106011	22Ω 1/2W 10%	R92	1	1	
260		720383	DIODE ZENER 1N4585	CR21, 22	2	1	
261		720384	1N4384	CR1, CR2	2	1	
262		100409	1N968	CR29	1	1	

REVISIONS
DESCRIPTION

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE I
				525

PLANNER	PREP DATE	SYSTRON DONNE CORPORATION
	CHK'D	SHIPPING ASS'Y
MAT. DUE	APP'D	RS320-1.5B
B/U REQ.		DRAWING NO.
B/U COMP		REF SIZE PART NO. — P 004090

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT. CODE	ISS. QTY	SHT QTY
264			COMPONENT BD #3 - ASS'Y (CONT.)		X	X		
266		800254	CAPACITOR .22MF-400V	C11	1	1		
267		800295	.47MF-400V	C12	1	1		
268		810060	35MF-25V	C13				
269		800185	0.1MF-250V	C32	1	1		
273			CHASSIS - CABLE RUN	PD13042	1	R		
277		T942029	AC - HARNESS		1	2		
278A		PD13032	" " - LIST					
279		RS29	" " - LAYOUT					
281		T942030	DC - HARNESS		1	2		
282		PD13034	" " - LIST					
283		RS30	" " - LAYOUT					

REVISIONS DESCRIPTION	REV

MODEL	JOB NO.	LOT QTY	LOT NO.	CODE IDENT
				52542

PLANNER	PREP DATE	SYSTRON DONNER CORPORATION
	CHK'D	SHIPPING ASS'Y RS320-1.5B
MAT. DUE	APP'D	
B/U REQ.		DRAWING NO.
B/U COMP	USED ON	REF — SIZE P — PART NO. 004090 — REV
		SHEET 9 OF 9

FORM 58-A 11 JUL 75

REVISIONS					
LTR	DESCRIPTION	ECN NO.	DRAWN	DATE	APP'D
C	REDRAWN FROM 'E' SIZE			9/80	RB

REF SUPPLY VOLTAGE REGULATOR

VOLTAGE MODE ERROR AMPL

CURRENT MODE LAMP AMPL

I MODE AMP

PRE-DRIVER

T2 505578A

T1 505575C

TB1

TB2

TB3

RVP

RIP

NOTE:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS ARE IN OHMS, 1/2W, 10%. ALL CAPACITORS ARE IN MICROFARADS.
2. * DENOTES SELECT AT TEST.

LIST OF MATERIALS

MODEL RS320-1.5B-SG181

SCHEMATIC

120730

MP MASTER
MA32286